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DISPOSAL OF HYDROGEN CYANIDE (HCN) AT TOOELE ARMY DEPOT, UTAH. --ETC(U)
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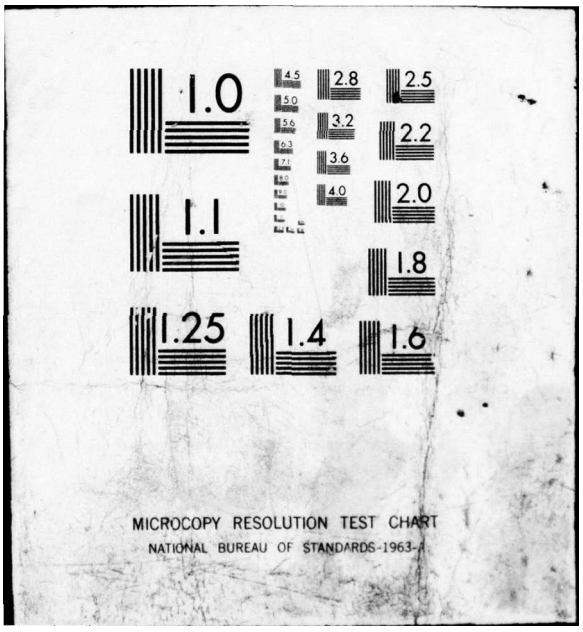
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Disposal
Blood Agent

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A plan for disposal of HCN contained in two inert bombs stored at Tooele Army Depot (TEAD) is described. The method of disposal is incinerator in an APE 1236 furnace located at TEAD. Environmental restraints, safety, facilities and clean-up are described.

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FOR
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ABERDEEN PROVING GROUND, MARYLAND 21010

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DISPOSAL OF HYDROGEN CYANIDE (HCN) AT TOOELE ARMY DEPOT, UTAH DISPOSAL PLAN

JANUARY 1978
(REVISED JUNE 1978)

PREPARED BY:

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CONTENTS

DISPOSAL OF HYDROGEN CYANIDE (HCN) AT TOOELE ARMY DEPOT, UTAH

I. INTRODUCTION

A. Two AN-M79 chemical agent bombs containing 281 pounds of hydrogen cyanide (chemical agent symbol AC) are stored at Tooele Army Depot (TEAD), Utah. These bombs are all that remain of a large number of bombs filled in 1944-45 and the former stockpile of agent AC. The majority of the HCN bombs stored at TEAD were destroyed by open burning in the late 1950s. In July 1976, these two bombs were reclassified from condition code E (unserviceable, limited restoration required) to condition code H (unserviceable, condemned) for disposal.

B. The HCN is identical to commercially available hydrogen cyanide. Over 300 million pounds of HCN are produced annually.

C. The chemical industry routinely disposes of HCN by incineration. This plan describes an incineration procedure proposed to destroy the HCN at TEAD.

II. CONCEPT OF OPERATIONS

A. The two HCN bombs are currently stored in the toxic gas storage area, located within the South Area of TEAD. The bombs are in good physical condition, do not contain explosives or propellants, and are suitable containers for transport of the HCN within the reservation to the disposal site.

B. Controlled incineration in an existing facility at TEAD is the planned method of disposal for the HCN. This is a simple procedure used widely by industry for disposal of cyanide materials. The HCN will be fed from the bombs into the incinerator. The bomb casings will then be rinsed with a caustic/bleach decontamination solution and thermally treated to assure removal of all HCN.

C. The incinerator facility is located within the South Area of TEAD; thus, all operations, including transportation, which involve handling of HCN will take place within the chemical restricted area of TEAD.

D. Disposal operations are planned to take place on two consecutive or non-consecutive days, depending on existing weather conditions and forecasts.

E. Liquid and solid waste generated by this operation will be disposed of in accordance with existing installation policy/regulations. The

decontamination solution used to rinse the bomb casings and equipment will be contained, analyzed and determined free of HCN, and transferred to the CAMDS facility for drum drying, drumming and eventual disposal as solid waste in a sanitary landfill.

III. RESPONSIBILITIES

A. The Department of the Army (DA) is responsible for maintaining storage of toxic chemical agent-filled munitions for all the military services. The US Army Materiel Development and Readiness Command (DARCOM) serves as responsible agency within CONUS for maintaining the stockpile items.

B. The two AN-M79 HCN bombs at TEAD have been declared obsolete and require disposal. The Office of the Project Manager for Chemical Demilitarization and Installation Restoration (PM CDIR) is responsible for the disposal of the items.

C. PM CDIR will plan for and direct demilitarization actions.

D. Tooele Army Depot will, upon receipt of authorization, conduct disposal operations.

E. The US Army Environmental Hygiene Agency (USAEHA) will provide environmental monitoring support.

IV. ITEMS FOR DISPOSAL

A. The items to be disposed of are two AN-M79 chemical agent gas bombs (photograph and drawing at Appendix A) containing HCN. Table 1 provides quantity of HCN in each bomb.

TABLE 1

Bomb	Lot Number	HCN Net Weight (lb)	HCN Volume (gal)
1	ACCO 51	175	29.7
2	ACCO 53	106	18.0
Total Agent		281	47.7

B. Agent Characteristics:

1. HCN (agent AC) is a non-persistent blood agent. It is commercially available hydrogen cyanide stabilized by addition of small amounts

of sulfuric acid/sulfur dioxide and phosphoric acid. See Appendix A, page A-3, for an analysis of the HCN in the bombs.

2. Properties.

a. Chemical name - hydrogen cyanide.

b. Chemical formula - HCN.

c. Molecular weight - 27.03.

d. Vapor density (air = 1.0) - 0.947.

e. Liquid density at 68°F - 0.69 g/ml.

f. Freezing point - 8.2°F.

g. Boiling point at 1 atmosphere - 78.3°F.

h. Vapor pressure at 68°F - 620.4 mm Hg.

i. Color - clear, water-white.

j. Odor - bitter almond.

k. Flash point - 0°F closed cup.

l. Explosive limits - 6-40% by volume in air.

3. Medical Aspects.

a. The time-weighted average threshold limit value (TLV) for HCN is 10 parts per million in air, or 11 milligrams per cubic meter of air (as recommended by the American Conference of Governmental Industrial Hygienists).

b. HCN interferes with utilization of oxygen by the body by inhibition of the enzyme cytochrome oxidose. The median lethal dosage (LCt_{50}) varies widely with concentration because of the rather high rate at which HCN is detoxified by the body. For example, at 200 mg/m^3 concentration, the lethal dosage is approximately 2,000 $mg\text{-}min/m^3$, whereas at 150 mg/m^3, the lethal dosage is approximately 4,500 $mg\text{-}min/m^3$ (Department of the Army FM 3-9, October 1975).

c. The rate of detoxification is rapid - 0.017 mg/kg/min. In less than acute cases, there is rarely any disability (FM 3-9).

d. After a lethal dosage, death occurs within 15 minutes.

e. The duration of effectiveness of HCN is short. It is highly volatile and in the gaseous state it is lighter than air.

V. SITE DESCRIPTIONS

A. The HCN is presently stored in the bombs at the chemical and ammunition storage area at Tooele Army Depot, South Area (Appendix B, pages B-1 and B-2).

B. The HCN will be transported over an access route as shown in Appendix B, page B-2. The route is over all-weather roads.

C. The disposal site is the TEAD deactivation furnace test site. It is located within the South Area of TEAD approximately 7,600 feet southwest of the nearest boundary.

D. The chemically decontaminated bomb shells will be heat treated in an existing furnace in the TEAD North Area (see map, Appendix B, page B-3).

E. Electric power, water and other utilities are available at the disposal site.

F. The area has ready access within the installation to medical treatment facilities and personnel equipped and trained to handle HCN casualties.

VI. DESCRIPTION OF EQUIPMENT

A. The bulk of the disposal equipment consists of the APE 1236 deactivation furnace facility located in the South Area of TEAD.

B. The HCN will be fed from the bomb through a closed controlled flow system into the incinerator. A schematic of the feed system is inclosed in Appendix C, page C-1. The HCN bomb will be pressurized with nitrogen to drive the HCN initially, with additional nitrogen available for repressurization and purging. The tubing of the feed system will be connected directly to the sampling valve on the bomb.

C. The furnace consists of a cast steel revolving retort, a fuel oil burner, combustion air blower, exhaust stack, and control panels. (The system also includes feed and discharge assemblies and conveyors for feeding obsolete munition and recovering metals which will not be used for the HCN operation.) The furnace will be operated with Number 2 fuel oil. Flame temperature is maintained by automatically modulating the burner as the need is indicated by a temperature recorder/controller in the control panel. Fuel consumption rates range from 6 to 23 gph. Two thermocouples continuously record temperatures: one immediately above

the flame which provides a reference temperature to the temperature recorder/controller, and the other at the base of the exhaust stack. The configuration of the spiral flight within the retort assures turbulent flow with good mixing through the length of the retort.

D. Deactivation furnace gases proceed through a duct to the afterburner. There, residual HCN will be burned at 1500°F or above. The outlet temperature of the afterburner is controlled by modulating the fuel oil firing rates. The gases then pass through a fresh water quench for cooling and a cyclone for removal of particulates prior to exiting through the 50 foot stack.

E. A schematic of the facility is inclosed at Appendix C, page C-2, and a layout of the system is at Appendix C, page C-3.

F. During actual disposal, critical process parameters of the system will be monitored. If temperatures drop below 1400°F in the afterburner or exceed safe operating conditions for the system, emissions or area HCN concentrations exceed acceptable levels, or other adverse conditions develop, the HCN feed will be terminated.

G. Ancillary equipment, including tanks for storing decontamination solution and brine generated from decontaminating the bombs, will also be located at the site.

VII. DISPOSAL REACTION

A. The HCN will be destroyed by burning with excess air. The basic gaseous effluents are water, carbon dioxide, nitrogen and excess air. A minimum temperature of 1100°F will be maintained in the burner end of the incinerator and 1500°F (nominal) in the afterburner. HCN has an auto-ignition temperature of 1000°F; therefore, combustion efficiency will be high and emissions of HCN will be well below the emission limit of 1.7 pounds per hour (see Appendix D, page D-1, for emission limit development).

B. The basic equation for the reaction is:

$$2HCN + \frac{5}{2} O_2 \longrightarrow 2CO_2 + H_2O + N_2$$

C. Using a computer simulation of the incineration reaction (Computer Program for Calculation of Complex Chemical Equilibrium Compositions, developed by the National Aeronautics and Space Administration), the theoretical concentration of HCN in the effluent gases was determined as less than 1.4×10^{-5} mg/m^3 using 45 pounds/hour of HCN feed rate and a range of furnace operating conditions which include the proposed operating conditions of the APE 1236 furnace retort.

VIII. SAFETY

A. General:

1. The Officer in Charge (OIC) is responsible for all safety aspects of the conduct of the disposal operation. A depot safety representative knowledgeable of HCN safety precautions and requirements will be at the site to assist the OIC. The number of personnel at the site will be limited to the minimum considered essential for conduct of operations. During operations, personnel in the operation area will be limited to: two security guards, one safety representative, three Ammunition Equipment Office personnel, six USAEHA representatives, three Ammunition Surveillance Division personnel, two trained medical technicians, and six transients. Occupancy in the control room will be limited to six; entrance into the furnace barricade will be limited to three; and entrance into the afterburner building will be limited to six. No individual will be permitted alone or unobserved in any operations area.

2. Disposal operations will be conducted only under stable weather conditions. Winds in excess of 20 mph or electrical storms will result in termination of operations. Wind direction indicators will be provided at the disposal site and an audible warning device will be available for use in the event of agent release.

3. Should a leak occur, decontamination procedure for the areas and structures enclosing the disposal facility will be ventilation with verification of decontamination using bubblers and M8 alarms. Ventilation is an effective decontamination procedure due to the extremely volatile characteristics of the liquid and the effective breakdown of the molecule which naturally occurs in the atmosphere.

B. Medical Services:

1. A vehicle capable of transporting prone casualties will be immediately available at the disposal site. It will be equipped with a communication system and will contain all necessary medical supplies to give first aid treatment for agent AC casualties. The medical dispensary at the South Area is located 2¼ miles from the disposal site and will be staffed with emergency medical technicians to provide more complete treatment. These emergency medical technicians are specially trained, equipped and capable of handling any casualty resulting from this operation. A physician will be on duty or immediately available in an alert status at the health clinic in the North Area during the entire operation.

2. All operating personnel will be trained in the recognition of agent symptoms and will be capable of rendering first aid or self aid treatment. A special orientation and training session will be conducted by the civilian employees health clinic for all personnel actively engaged

in the disposal operation, specifically addressing HCN symptoms and treatment. Up-to-date toxic agent medical examinations will be required for all personnel assigned to the disposal operation.

3. In accordance with existing agreements between TEAD and nearby support hospitals (Tooele Valley, Hill AFB, Veterans Administration Hospital in Salt Lake City, Univeristy Medical Center in Salt Lake City, and LDS Hospital in Salt Lake City), the hospitals will be notified in advance of the HCN operation and will accept any casualties resulting from the operation and requiring further treatment.

C. Communications:

1. Telephone services will be provided between the disposal site and the Emergency Operations Center (EOC) and other depot facilities. Radio communication will be available as a backup system from the disposal site and will serve as primary communication during convoy movements. A separate radio network will be available as a backup for medical emergencies.

2. Normal communication between personnel in the operations area will be by voice contact, hand signals, and hand-held portable radios.

D. Agent Detectors:

1. Work area monitors will be located in strategic locations (Appendix C, page C-3) to insure maintenance of a safe working environment in areas where protective clothing will not be required and to assure that all areas are contamination free after completion of operations. The monitors will be capable of detecting .05 mg/m^3. In addition, M8 alarms will be available in the work area with a detection capability of .1 mg/m^3.

2. The time weighted average threshold limit value for HCN no effects is 10 ppm (11 mg/m^3). Area monitor detector results at a value of 20 ppm (16.5 mg/m^3) will cause all operations to be terminated. Area monitor detector results at a value of 11 mg/m^3 will cause all personnel to mask and take action to identify and eliminate the source of high readings. All personnel in the immediate disposal area will wear level B protective clothing during operations (see Appendix E).

3. Exhaust gases will be monitored downstream from the furnace retort (Appendix D, page D-2). Permanent records of detection results will be maintained and the OIC will be notified of any evidence of agent concentration. Stack emissions of 150 mg/m^3 will require action to limit emissions. A concentration of 275 mg/m^3 will require shutdown of the HCN feed. The procedure for analysis of the area and emission samplers is summarized at Appendix D, page D-3.

E. Agent Transportation:

1. Daily transportation of a single HCN bomb will be accomplished during daylight hours under security escort. A convoy will be formed of support vehicles and will include, in order, security vehicle, aid truck, bomb transport vehicle, decontamination vehicle, and security vehicle. Sufficient equipment and personnel will be carried in the convoy to cope with any accident or incident involving HCN.

2. The convoy will travel over the approved route entirely within the South Area and will not exceed speeds of 20 mph.

F. Protective Clothing:

1. All personnel involved in any aspect of the disposal operation will have an M9 protective mask in their possession at all times.

2. Protective clothing (level B as in Appendix E) will be available for use during bomb transport vehicle loading, bomb convoy transportation, and disposal operations at the disposal site.

3. Complete protective clothing (level A as in Appendix E) will be worn during first entry monitoring of the storage igloo prior to loading the bomb onto the transport vehicle.

4. Protective clothing (level B as in Appendix E) will be worn during monitoring of the closed bomb transport vehicle upon arrival at the demilitarization site.

5. Protective clothing (level B as in Appendix E) will be worn by workers completing the feed system hookup to the AC bomb until agent flow is established and no leaks are detected and during any re-entry into the furnace area during operations.

IX. DISPOSAL PROCEDURES

A. Pre-Operational Procedures:

1. The Emergency Operations Center in Building S-10 will obtain a weather report and a forecast of wind speeds, wind direction, and temperature from the National Weather Service at Salt Lake City International Airport. TEAD personnel will measure the weather conditions at the South Area of the installation. This information will be furnished to the installation commander and the OIC of disposal operations. The OIC will verbally request the commander to authorize disposal operations. If permission is granted, the commander will be advised of the estimated completion time. The EOC will advise all operational, support and response teams when operations are in effect (and when operations are

completed). All communication nets will be tested to assure that they are operational before disposal operations commence. When all personnel are onsite and ready, the EOC will give approval for operations to begin.

2. Prior to movement of the bomb, the incinerator, afterburner, and all associated equipment will be started and allowed to reach a steady operating state in accordance with appropriate SOPs and operating manuals.

B. Movement Procedures:

1. Preparation. The HCN bombs will be inspected in accordance with the procedure at Appendix F to assure that valves and plugs are not leaking. If a leak is detected, the leaker will be sealed in a suitable overpack container and the area decontaminated in accordance with surveillance and maintenance procedures. All equipment will be inspected to assure proper functioning.

2. Loading. When it has been determined that the HCN bombs are safe for movement, the signal to load will be given. One bomb will be moved per day of operation. When the bomb has been placed on the inclosed transport vehicle, it will be blocked and braced to assure safe transportation (Appendix F).

3. Movement. After loading and preparation for transport, the HCN will be escorted over the approved route to the disposal site. The bomb will be rechecked for leakage and unloaded onto the support stands in the proper position.

C. Feed System Hookup:

1. After assembly of the feed system, it will be pressure checked to 50 psig.

2. After the HCN bomb is in position, the feed system will be purged with nitrogen. A slight flow of nitrogen will be maintained through the feed system during hookup to the bomb sampling valve.

3. After disposal personnel have determined that all system valves are closed (except for the nitrogen supply to the sampling valve connection), the HCN bomb will be connected to the feed system.

4. The nitrogen pressure in the line will then be increased to 20 psig and the sampling valve connection leak tested.

5. No HCN will be fed into the system until the incinerator and afterburner have reached proper operating temperatures with the required excess air flow into the system.

D. Incineration Procedures:

1. The bomb sampling valve will be opened to determine the pressure within the bomb and the bomb will be pressurized to 20 psig with nitrogen.

2. A signal will be given to proceed and operators will close off the nitrogen valve, open the HCN feed valve and return to the safety zone.

3. The flow rate will be monitored and adjusted as required (nominal feed rate is 45 pounds per hour).

4. If the liquid flow from the bomb stops, the feed valve will be closed and the bomb will be repressurized with nitrogen.

5. If the sampling valve on the bomb becomes clogged, nitrogen will be used to attempt to dislodge and clogged material (not more than 40 psig). If the valve remains clogged, it will be shut off, the bomb will be disconnected from the feed system, inverted, and placed back into position. If, after reconnection to the feed system, the valve is still clogged, the bomb will be disconnected, returned to the storage area, and the valve will be replaced in accordance with normal depot maintenance procedures (i.e., freeze the HCN, then change valve).

6. When all the liquid agent has been fed into the incinerator, the bomb will be flushed with nitrogen. This mixture will be fed into the incinerator.

7. The bomb sampling valve will be closed and the bomb disconnected from the feed system.

E. Bomb Decontamination Procedures:

1. After the bomb has been disconnected from the feed system, it will be repositioned with the needle valve at the top. The decon tank will be pressurized with decontamination solution fed into the bomb. When the internal pressure in the bomb reaches 20 psig, decontamination solution flow will stop and the bomb will be vented into the deactivation furnace.

2. The chemical neutralization of HCN by decontamination solution is as follows:

$$2\ HCN + 5NaOCl + 4NaOH \longrightarrow N_2 + 2Na_2CO_3 + 5NaCl + 3H_2O$$

3. Active ingredients in the decontamination solution will be in sufficient strength to decontaminate residual HCN coating the surface as well as the small quantity of liquid and solid material remaining in

the bomb (solids could consist of a small quantity of ferrous material resulting from corrosion of the interior surface of the bomb). However, based on routine surveillance, little, if any, solids are contained in the bombs.

4. After the bomb has been filled with decontamination solution, the bomb and holding pallet will be moved to an isolated outdoor site. The needle valve will be left open to vent any non-hazardous gaseous reactants which may be generated by the neutralization reaction.

5. The incinerator will be shut down in accordance with operations SOPs.

6. After 24 hours, the decontamination solution will be checked for presence of HCN by cyanide specific electrode method (sensitivity of 12 ppb). The decontamination solution will then be transferred to a holding tank.

7. The bomb casings will be transferred to the North Area Demolition Range via two vehicle convoy, severed by a linear shape charge to render them unserviceable, and heated in the Ammunition Equipment Office flashing furnace to 1500^{o}F for 30 minutes. The bomb casings will then be treated as scrap metal. The flashing furnace area is a limited access area and only those personnel directly involved in this operation will enter the immediate area during heat treatment of the bomb casings.

X. EQUIPMENT DECONTAMINATION AND CLEANUP

A. Following completion of HCN disposal, the specially fabricated feed system will be flushed with decontamination solution, disassembled and soaked. The decontamination solution will be added to the bomb casing decontamination solution hold tank.

B. Following decontamination, the equipment will be transported to the North Area and heated to 1500^{o}F for 30 minutes in the flashing furnace and disposed of as scrap metal.

C. Operating parameters of the deactivation furnace are in excess of the autoignition temperature of HCN; therefore, it will be certified free of HCN contamination and available for use on other projects.

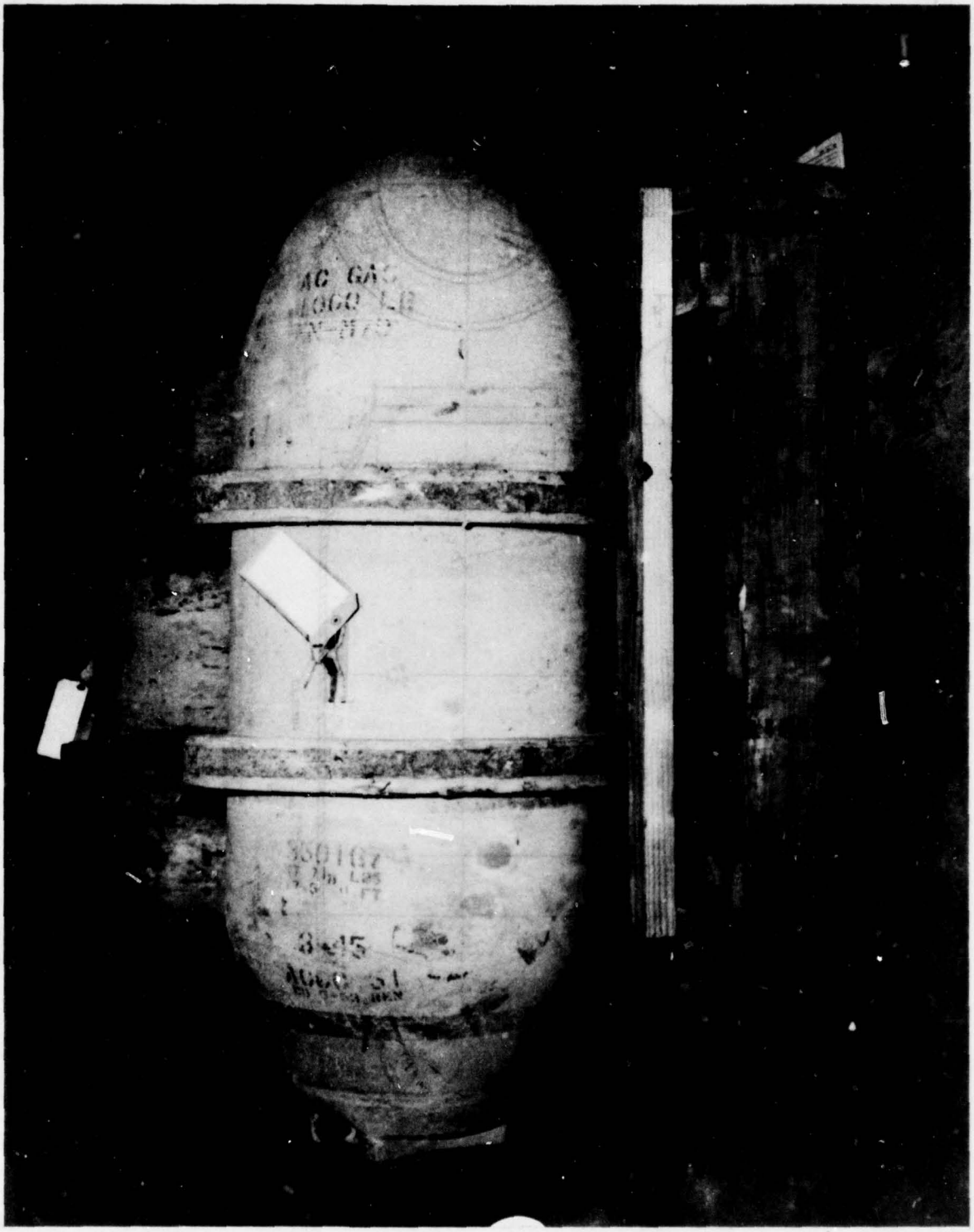
D. The decontamination solution, after tested for HCN and certified HCN free, will be transferred to the CAMDS facility, drum dried, and drummed for eventual disposal as solid waste in a sanitary landfill.

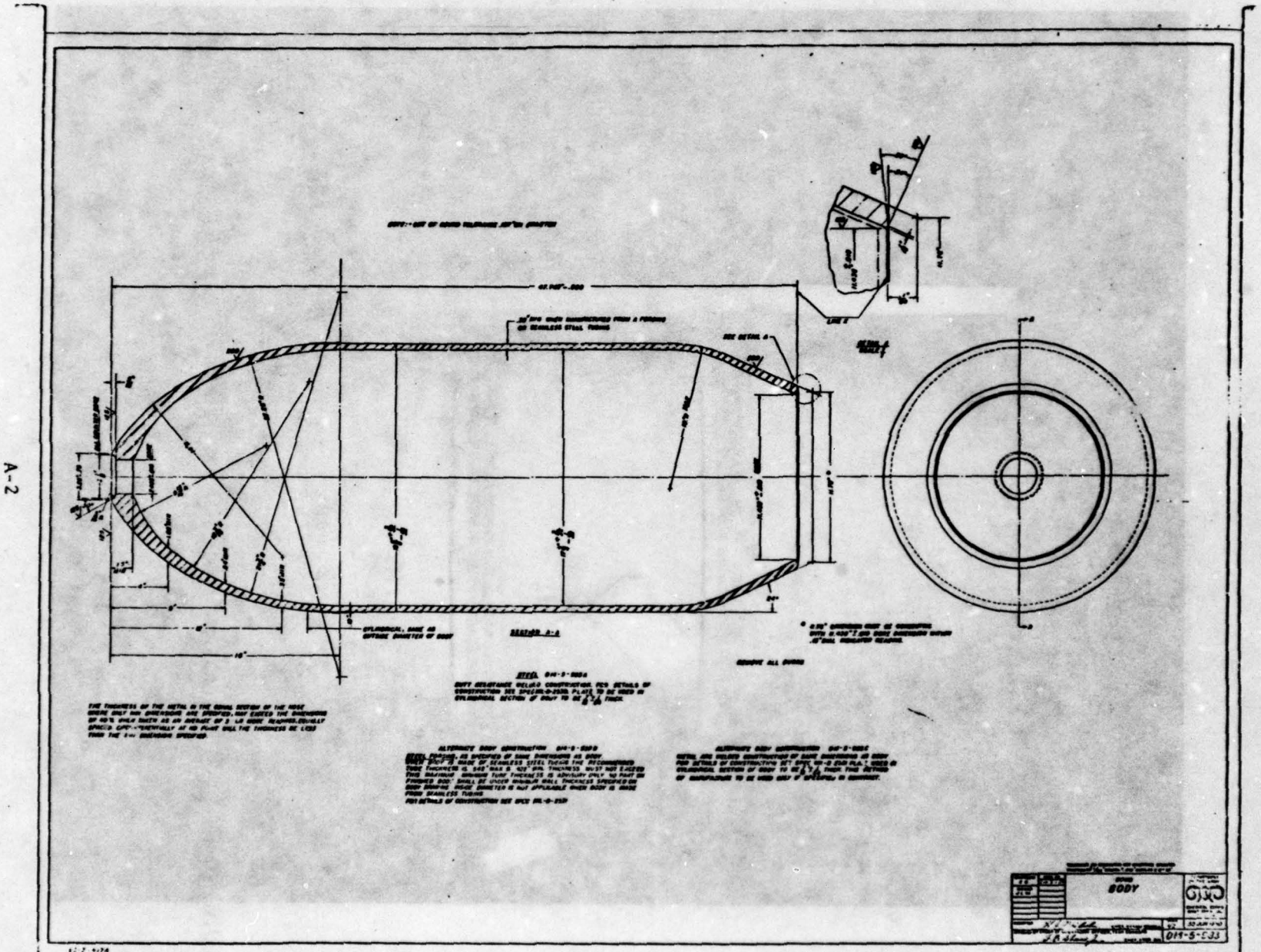
E. The enclosed bomb transport vehicle will be checked with a bubbler to verify that it is HCN free prior to returning to normal service.

F. Bubbler analyses of the work areas sampled before, during and, if necessary, after operations will be used to verify the areas HCN free.

APPENDIX A

DESCRIPTION OF BOMBS

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ANALYSIS OF HCN CYLINDERS

Sample	HCN (%)	H_3PO_4 (%)	SO_2 & H_2SO_4 H_2SO_4 (%)	Qualitive Metal* Emission Spectra
(3/45) ACC051	95.7	0.073	0.18	Trace of Mo Na Cu Ca
(6/45) ACC053	98.8	<0.003	0.14	Trace of Cu Ca Fe

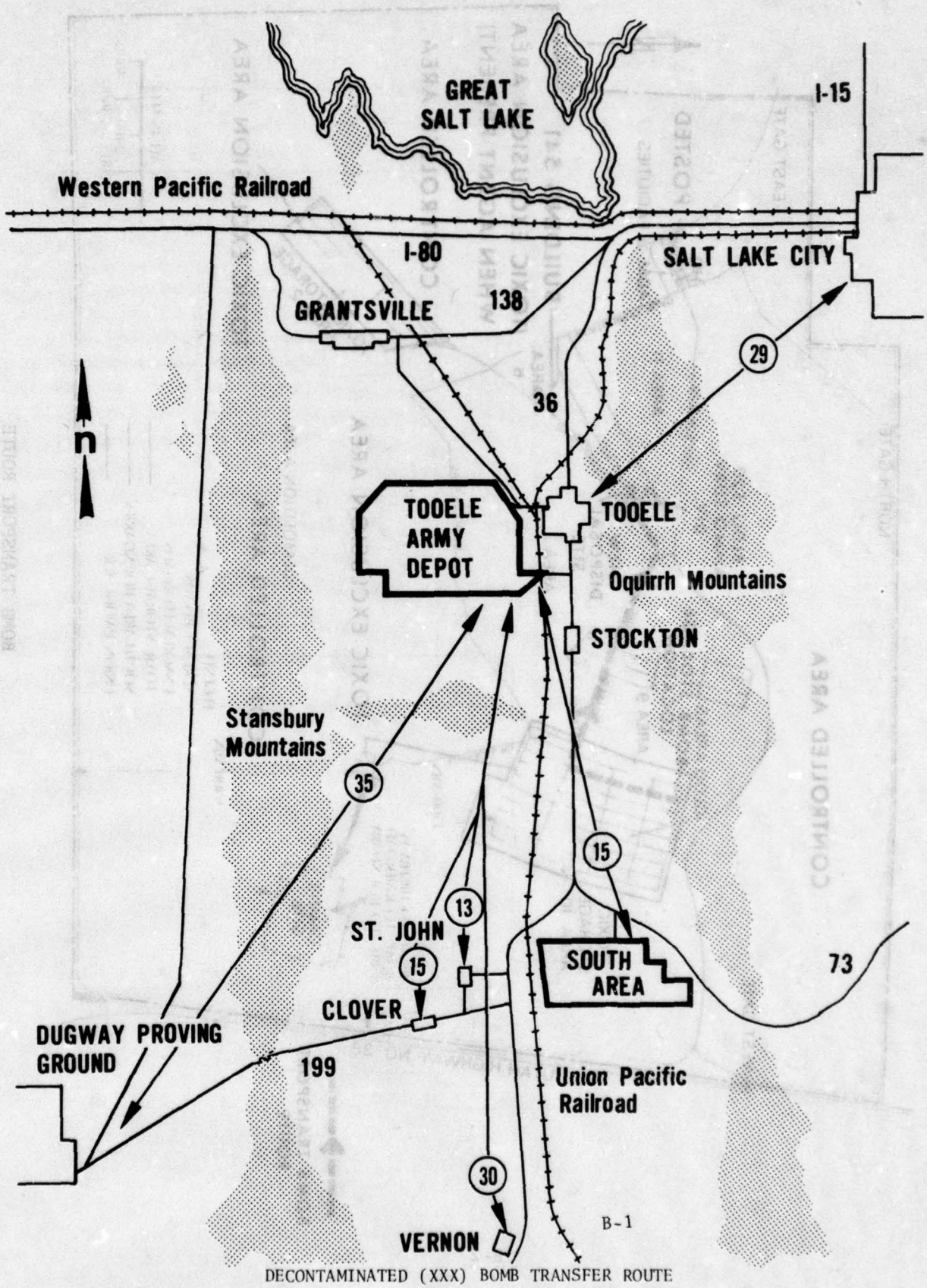
*No Hg, Pb or As was detected at a detection threshold of 100 ppm.

Subsequent to the emission spectra, the Hg, Pb, As contents were analyzed by the Atomic Absorption technique. A 10 ml sample (12.5 gm) of each sample was evaporated at ambient temperature. The residue was acidified, and the resulting solution was analyzed for the metals. On both samples, the Pb was not detected with a detection limit of 1 ppm; Hg was not detected with a detection limit of 20 ppm; and As was not detected with a detection limit of 10 ppm.

Analysis performed by Analytical Chemistry Branch, Chemical Research Division, Chemical Laboratory, Edgewood Arsenal, 2 September 1974.

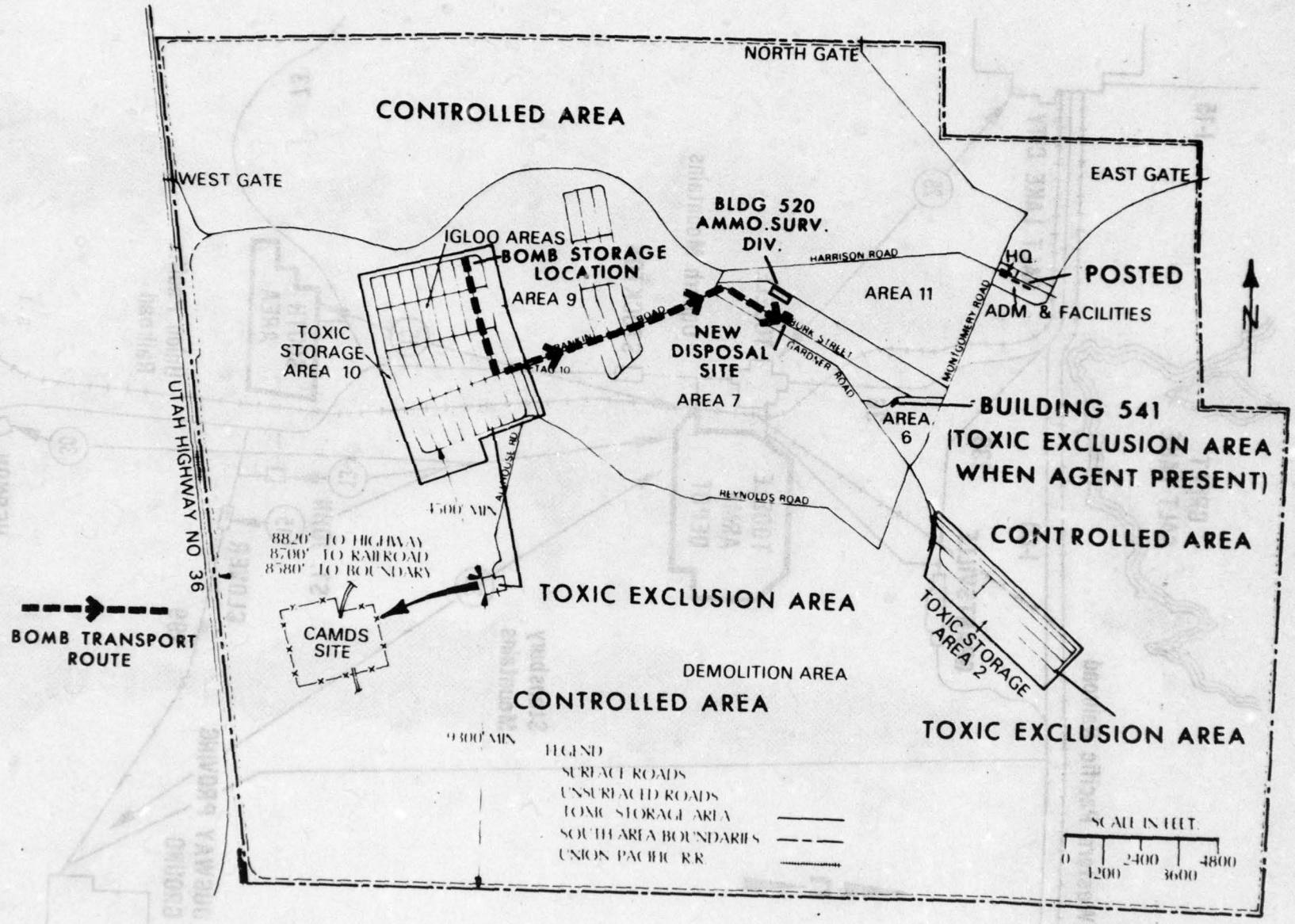
APPENDIX B

DISPOSAL SITE



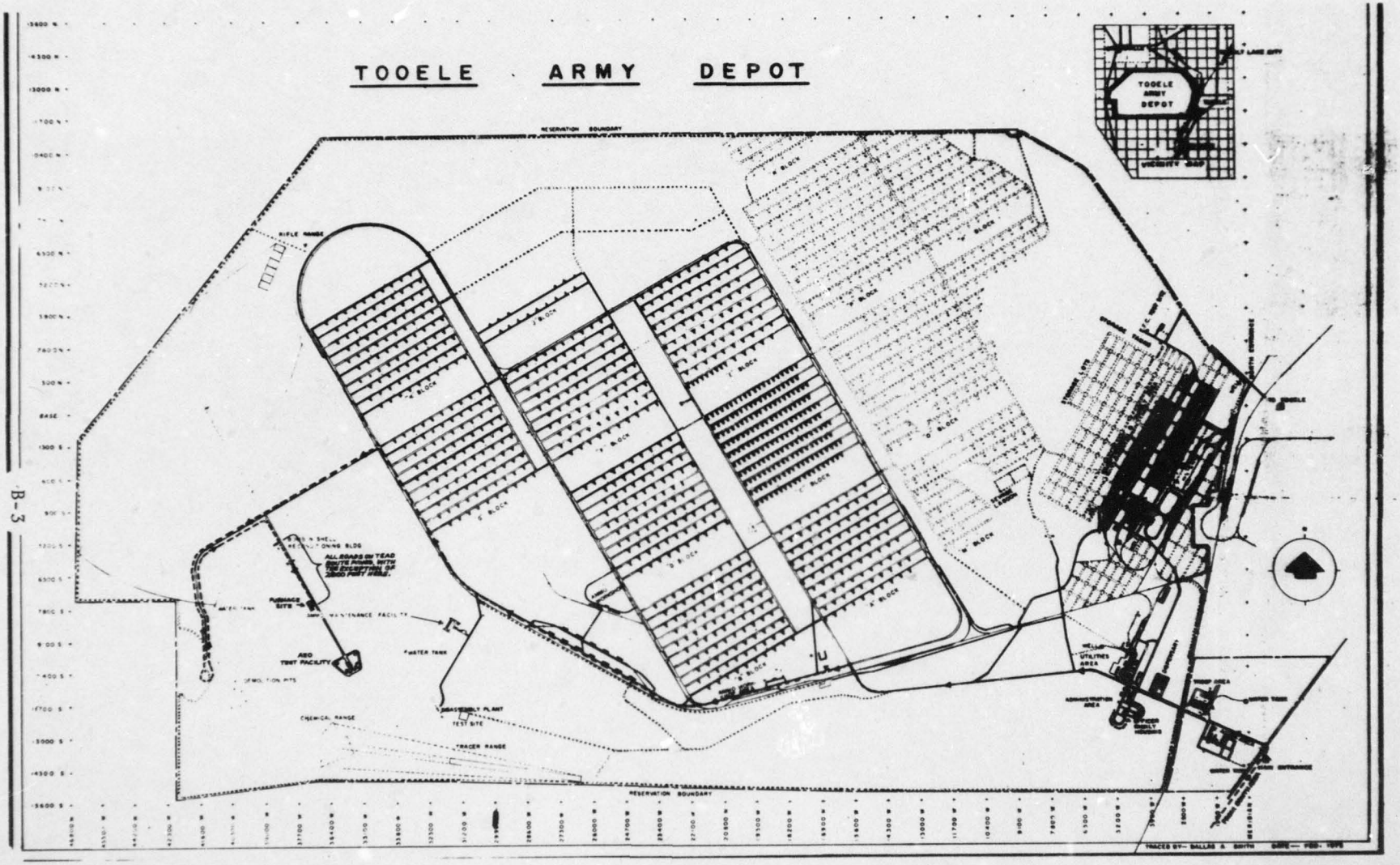
B-1

DECONTAMINATED (XXX) BOMB TRANSFER ROUTE



B-2

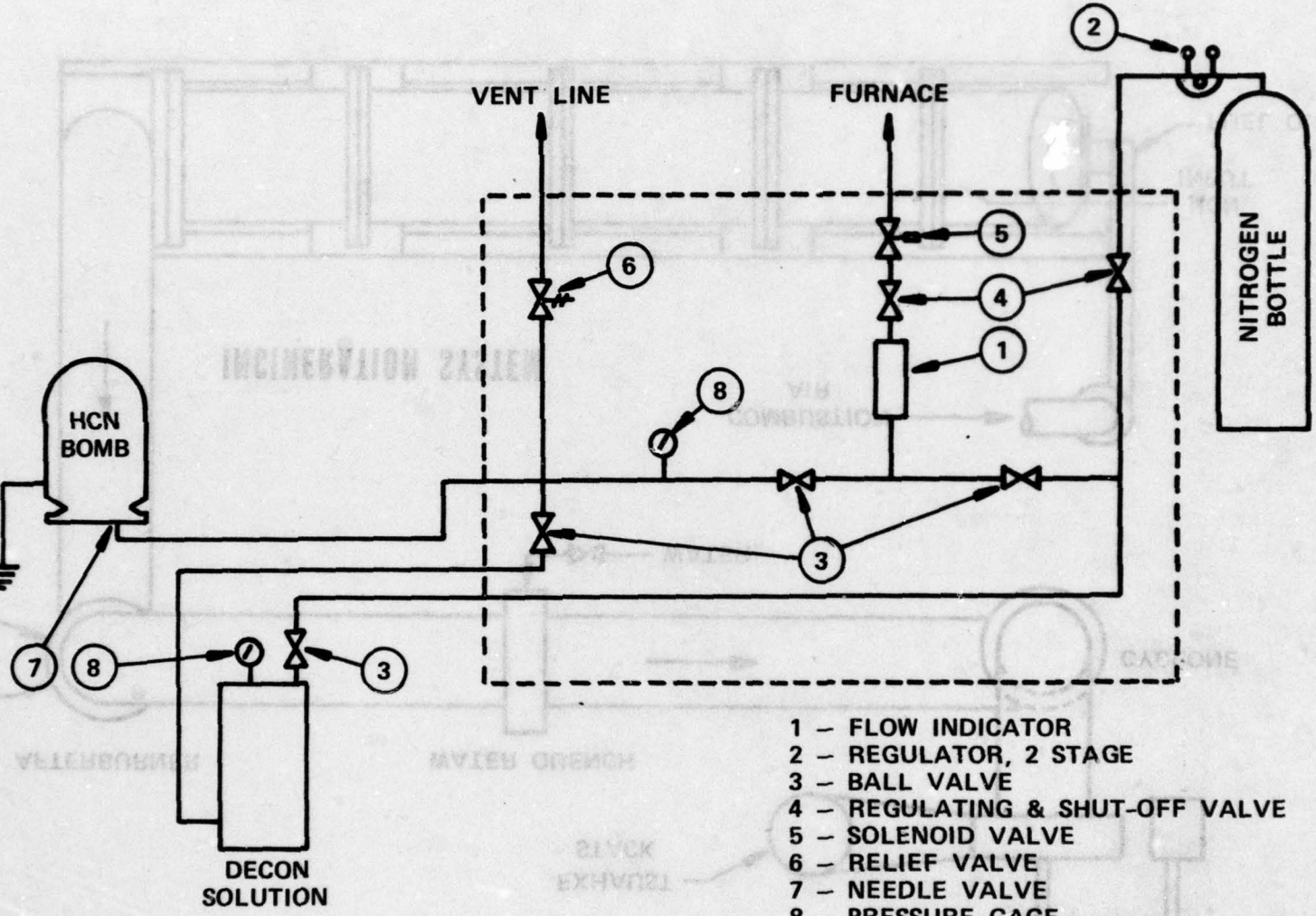
BOMB TRANSPORT ROUTE



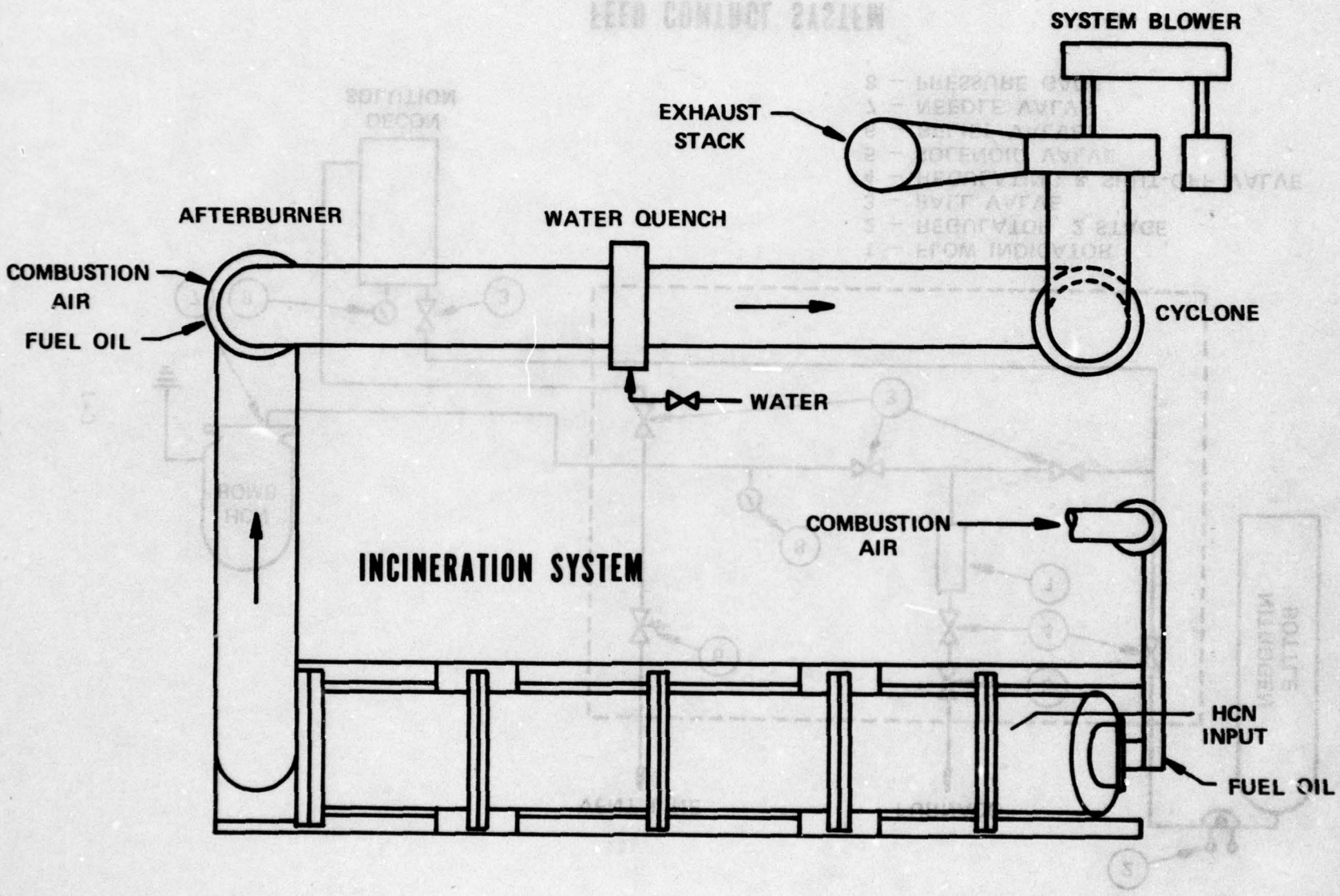
DECONTAMINATED BOMB ROUTE WITHIN
THE NORTH AREA, TEAD

APPENDIX C

EQUIPMENT

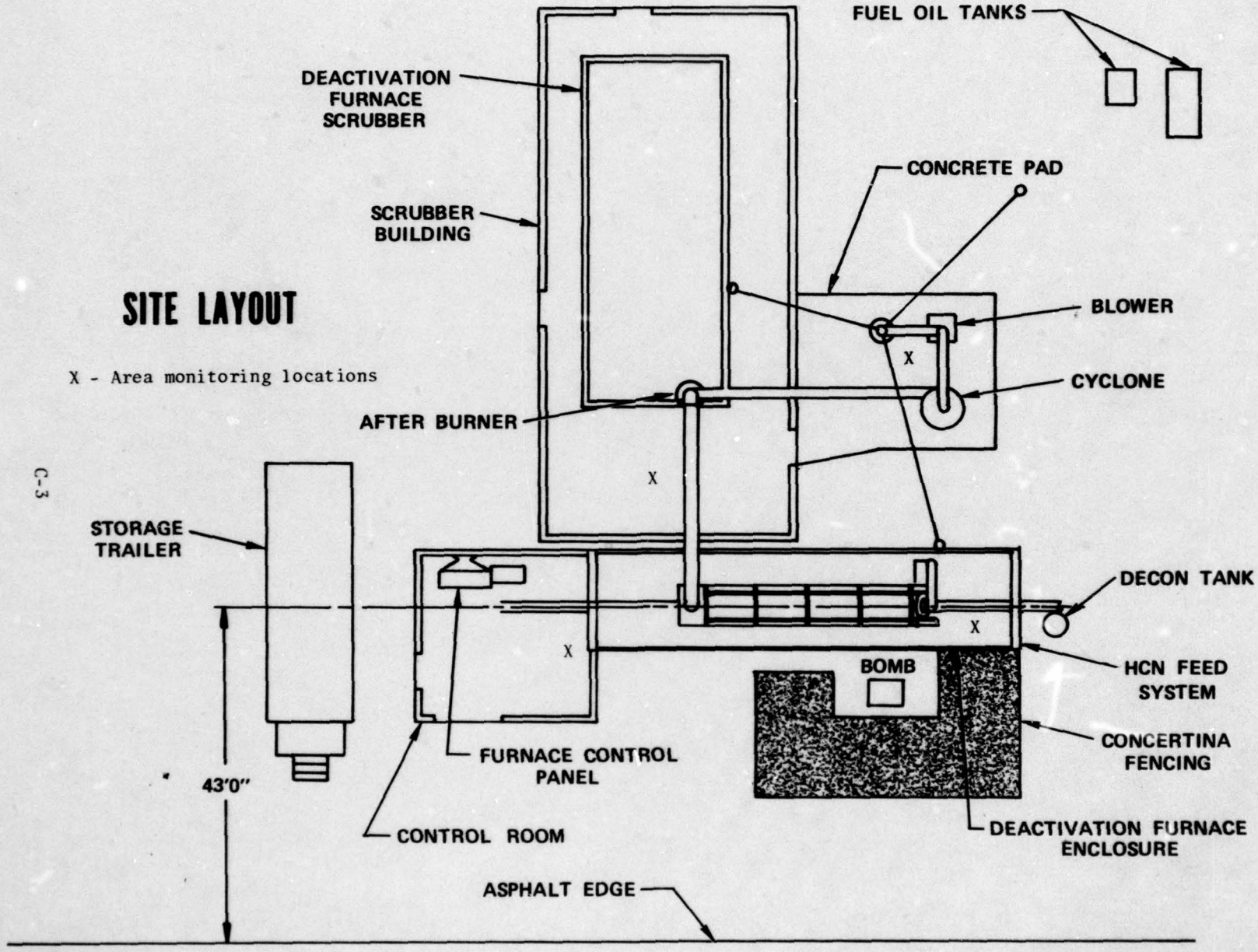


FEED CONTROL SYSTEM


SYSTEM BLOWER
EXHAUST STACK
AFTERBURNER
WATER QUENCH
COMBUSTION AIR
FUEL OIL
CYCLONE
WATER
INCINERATION SYSTEM
COMBUSTION AIR
HCN INPUT
FUEL OIL

SITE LAYOUT

X - Area monitoring locations



APPENDIX D

EMISSION LIMIT DEVELOPMENT

STACK EMISSION CRITERIA

1. Diffusion calculations were performed using 1/30 of the threshold limit value (TLV) for HCN of 11.0 milligrams per cubic meter (mg/m^3) as the maximum allowable ground level concentration. The methodology from Turner's "Workbook of Atmospheric Dispersion Estimates" was used for the calculations.

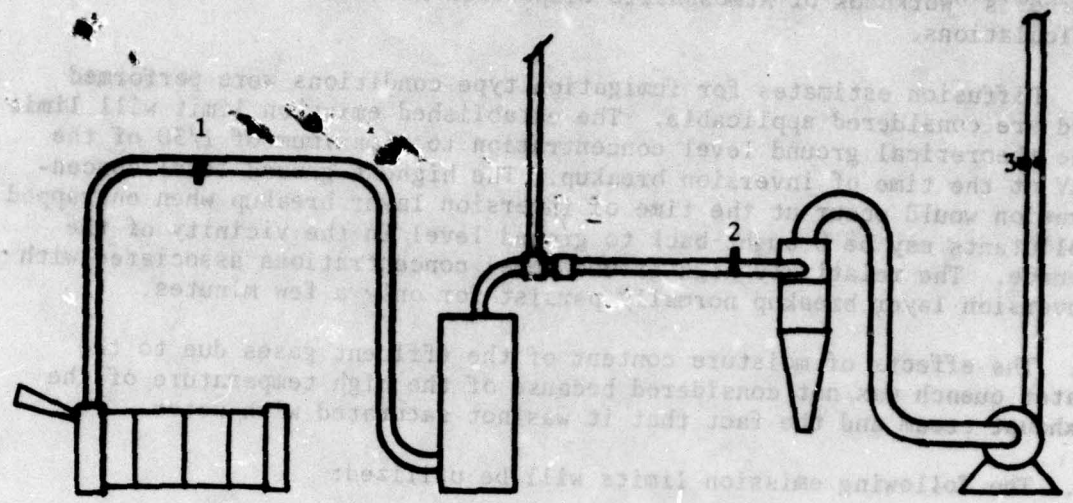
2. Diffusion estimates for fumigation type conditions were performed and are considered applicable. The established emission limit will limit the theoretical ground level concentration to a maximum of 1/30 of the TLV at the time of inversion breakup. The highest ground level concentration would occur at the time of inversion layer breakup when entrapped pollutants may be brought back to ground level in the vicinity of the source. The relatively high ground level concentrations associated with inversion layer breakup normally persist for only a few minutes.

3. The effects of moisture content of the effluent gases due to the water quench was not considered because of the high temperature of the exhaust steam and the fact that it was not saturated with water.

4. The following emission limits will be utilized:

   a. Action limit of 150 mg/m^3 HCN.

   b. Shutdown limit of 275 mg/m^3 HCN.



EXHAUST GAS SAMPLING LOCATIONS

(Sampling point 3 only will be used during HCN operations.)

ANALYTICAL PROCEDURE FOR HCN EMISSIONS

Air will be sampled at a constant flow rate of approximately 4 standard cubic feet per hour (2 liters/minute) using calibrated dry gas meter controllers. One hour sample trains, operated on a 30 minute overlap cycle, will each consist of a glass probe (eight sample holes) followed by three normal Greenburg-Smith impingers in an ice bath, each filled with 1.0N sodium hydroxide (NaOH).

Cyanide analysis will be performed using a cyanide specific electrode and a reference electrode calibrated with standard solutions of KCN in 1.0N NaOH.

AREA MONITOR SUMMARY

Location	Bubblers	M-8 Alarm	Comments
Furnace Control Room (page C-3)	2-hr bubbler	Yes	
Scrubber Building (page C-3)	8-hr bubbler	No	Portable alarm will be used if entry required.
Deactivation Furnace Enclosure (page C-3)	8-hr bubbler	Yes	All personnel in area will wear Level B protective clothing.
Blower, cyclone, stack area (page C-3)	No	Yes (portable)	Open area, will require entry for maintaining emission bubbler train on stack.
Building 520 (page B-2)	8-hr bubbler	Yes	Ammo Surv Div personnel will inhabit this building during operations and are tied into communication network for the operation.

APPENDIX E

PROTECTIVE CLOTHING

PERSONNEL PROTECTIVE CLOTHING AND EQUIPMENT

1. Level A

   Suit - coveralls, toxicological agent protective (M3)

   Hood - toxicological agent protective (M3)

   Butyl boots - safety toe, toxicological agent protective (M2A1)

   Butyl gloves (M3)

   Cooling suit (when required)

   Undershirt - unimpregnated

   Drawers - unimpregnated

   Socks - unimpregnated

   Masks - worn: M9 series

2. Level B

   Coveralls - explosives handlers, unimpregnated

   Hood - synthetic rubber, compatible with industrial mask

   Butyl apron - extending below top of boots (M2)

   Butyl boots - safety toe, toxicological agent protective (M2A1)

   Butyl gloves (M3)

   Undershirt - unimpregnated

   Drawers - unimpregnated

   Socks - unimpregnated

   Mask - worn: industrial gas mask with canister for hydrocyanic acid gases (US Bureau of Mines or NIOSH/MESA approved)

APPENDIX F

MOVEMENT DETAILS

SAFETY IN STORAGE INSPECTION PROCEDURE

1. Portable shower and decontamination equipment will be positioned 50 feet upwind from storage site.

2. The Chemical Surety Officer, Chemical Munition Branch, Medical Aid Station, Safety Division, Security Desk Sergeant and Chief, Ammunition Surveillance Division will be advised of working location and agents involved.

3. Place warning signs on access roads to the storage site.

4. Check audible alarm for proper working conditions.

5. Station radio-equipped vehicle 50 feet upwind from storage site. Establish radio communications with Chemical Munition Branch, Medical Aid Station and Security.

6. Personnel dressed in level A protective clothing will enter the storage area and visually inspect the bomb(s).

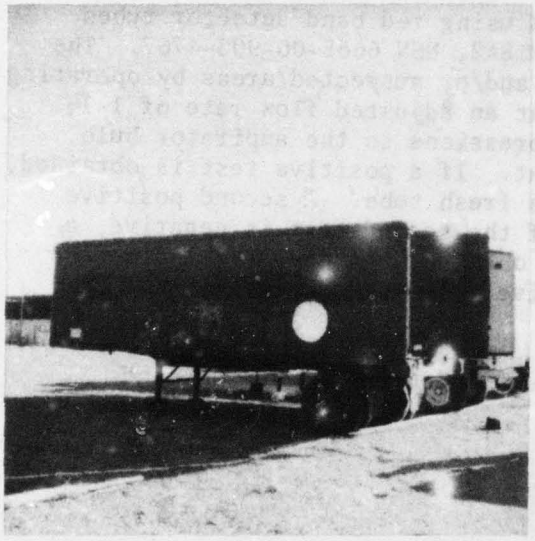
7. The bomb(s) will then be leak tested using red band detector tubes from Detector Kit, Chemical Agent, ABC M18A2, NSN 6665-00-903-4767. The air will be sampled around welded areas and/or suspected areas by operating an air sampling device for two minutes at an adjusted flow rate of 1-1½ liters per minute or by applying 60 compressions to the aspirator bulb. A blue color indicates that AC is present. If a positive test is obtained, a second test should be conducted with a fresh tube. A second positive test confirms the presence of agent. If the second test is negative, a third test using a fresh tube should be obtained. A negative third test indicates the absence of agent; a positive third test indicates the presence of agent.

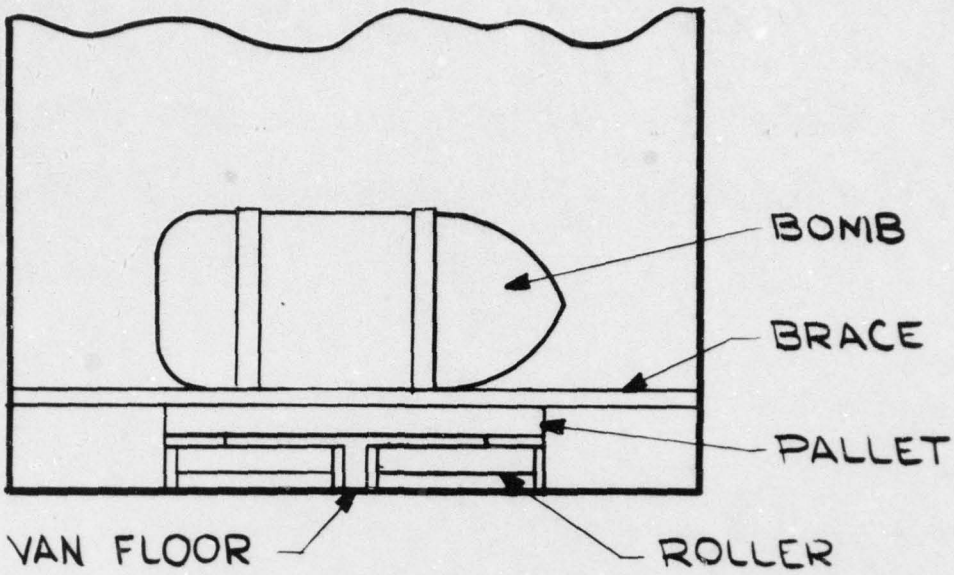
8. A leaking bomb will be decontaminated placed in an overpack and removed to an isolated area.

BOMB TRANSPORTATION

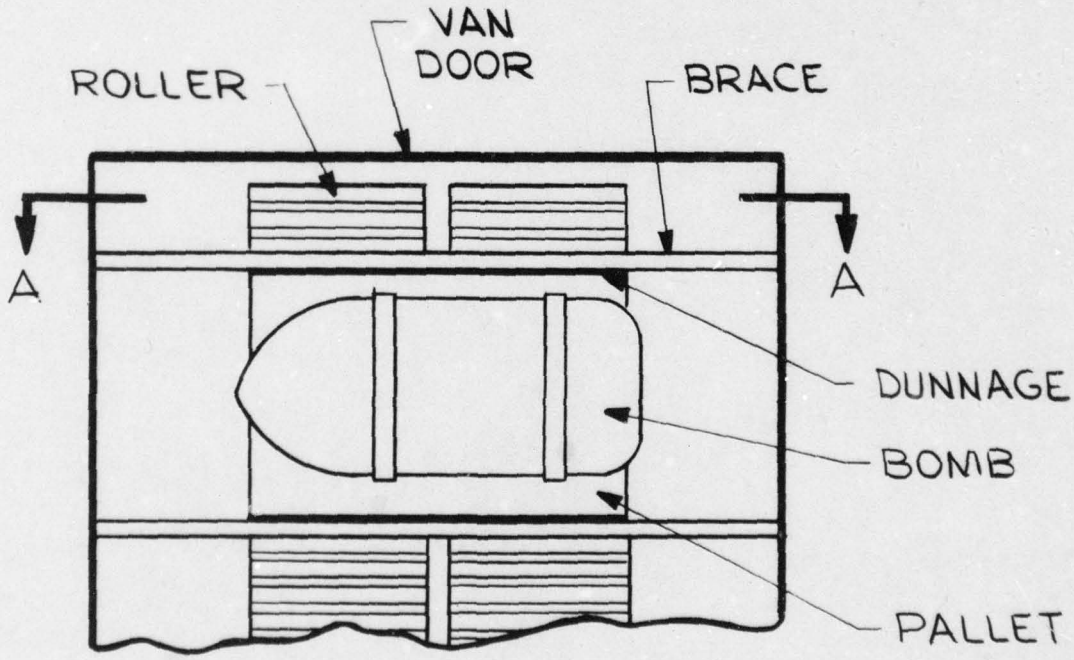
At the present time, the two AC bombs are both stored on the same pallet. Each bomb will be placed on a separate MC-1 bomb pallet. Each will be secured to their own pallet using 1¼ inch banding. Two bands will be tightened and sealed to prevent the bomb from moving. The bomb and pallet will be transferred from the storage site to the chemical van with a forklift truck.

The pallet will be placed on the roller conveyor on the floor of the van. The pallet will then be positioned in the van and secured using DF blocking equipment. The van will be sealed prior to movement from the storage area.




BOMB
BRACE
PALLET
VAN FLOOR
ROLLER

SECTION "A-A"


VAN
DOOR
ROLLER
BRACE
A
A
DUNNAGE
BOMB
PALLET